

# **Using Multi–Watershed Analyses to Analyze the Effects and Improve the Experimental Design of Ecosystem Restoration Actions**

**Angela L Moskow**

# Final Selection Panel Review

## Proposal Title

#0126: Using Multi-Watershed Analyses to Analyze the Effects and Improve the Experimental Design of Ecosystem Restoration Actions

## Funding:

Do not fund

This proposal received scores of: excellent, excellent and very good from independent technical reviewers. The Technical Synthesis Panel (TSP) gave it a rating of adequate due primarily to the lack of definition of later stages of the project approach provided in the written proposal and the concerns identified by the technical reviewers. The comment letter received clearly addressed the issues raised by the technical reviewers and the TSP. After reviewing the comment letter received, the Selection Panel considers that the clarifying comments do not merit changing the TSP's rating of adequate.

The Selection Panel did note that the public agencies could learn from reviewing the results of a pilot project conducted in the Columbia River basin, on which the proposed project is modeled. The researchers proposing this effort have a good track record and are a talented group of professionals. This approach is interesting even if it cannot be funded at this time. If more funds were available this would be worthwhile effort to pursue. One should note that before the public agencies pursue this with future public funds, the agencies and stakeholders that participated in and provided data for the Columbia River report might be consulted.

#0126: Using Multi-Watershed Analyses to Analyze the Effects and Improve the ...

## **Public Comments**

The following public comments were received for this proposal.



Protecting and Restoring San Francisco Bay from the Sierra to the Sea

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Grant Davis

DATE:

6-16-05

TO:

Ladd Lougee

ORGANIZATION:

CALFED Science Program

FAX:

877-408-9310

PHONE:

FROM:

Tina Swanson

COMMENTS:

Re: Proposal 0126

Using Multi-Watershed Analyses to Analyze  
the Effects and Improve the Experimental  
Design of Ecosystem Restoration Actions

Number of Pages (Including Cover Sheet): 8

# The Bay Institute

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June 16, 2005

Ladd Lougee  
Research Coordinator  
California Bay-Delta Authority  
CALFED Science Program  
650 Capitol Mall, 5th floor  
Sacramento, CA 95814

## **Re: Clarification for proposal #0126, "Using Multi-Watershed Analyses to Analyze the Effects and Improve the Experimental Design of Ecosystem Restoration Actions"**

Thank you for the opportunity to submit comments in response to the reviews and rankings of Proposal #0126: *Using Multi-Watershed Analyses to Analyze the Effects and Improve the Experimental Design of Ecosystem Restoration Actions*. We value the comments provided by all the reviewers, but we must admit feeling a bit puzzled by the Synthesis Panel's ranking of "adequate" in light of the three technical reviewers' overall rankings of "excellent," "excellent," and "very good." We realize that Science Program funding is limited and that the Synthesis Panel was left with the difficult task of selecting among numerous high quality proposals. We would like to take this opportunity to clarify our approach to evaluating the effectiveness of ecosystem restoration actions across multiple watersheds, and to relate our proposed work to the Science Program's solicitation and the CALFED Ecosystem Restoration Program's continuing need for tools for performance assessment.

CALFED is a large, complex, and expensive endeavor—both the Ecosystem Restoration and Science Programs have recognized that assessing the effects of CALFED's numerous and diverse actions will require development of both project-specific and programmatic performance measures. Performance measures are essential to guide adaptive management and effective allocation of restoration funds, and to facilitate communication of progress to interested stakeholders. We developed the "Multi-watershed" proposal to address this need and to respond to the Science Program's call for proposals that would "help CALFED agencies effectively measure direct responses to actions, and conducting independent technical reviews of performance assessment (CALFED Science Program PSP, page 5)." We focused our proposed work on ecosystem restoration actions implemented upstream of the Delta, where more than half of all Ecosystem Restoration Program funds (>\$300 million to date<sup>1</sup>) have been expended, and targeted our analyses on the responses of habitats and salmonids (another priority topic of the PSP). This multi-watershed approach offers opportunities to assess and compare different types of restoration actions in different river systems and to develop performance measures that could be applicable over the entire Sacramento-San Joaquin watershed. We do not offer the proposal as a "fix-all," but rather as an important step in the evolution of performance measures for CALFED's ambitious and important work.

CALFED has been striving to define and develop project and programmatic performance measures for many years: several of the authors of this proposal participated in or reviewed a number of these CALFED-sponsored efforts, including the CALFED Indicators

<sup>1</sup> CALFED Bay-Delta Program. 2003. Ecosystem Restoration Program Project Evaluation Phase 2 Report. Prepared by Kleinschmidt and Jones and Stokes for the CALFED Bay-Delta Program. \

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Workgroup,<sup>2</sup> the Environmental Defense Fund indicators workshop,<sup>3</sup> the ERP Indicators Team,<sup>4</sup> and the recent work by the CALFED Science Program.<sup>5</sup> These efforts made valuable progress in describing a framework for indicator development and identifying potential performance metrics at a variety of spatial scales, but CALFED has yet to develop, test, or adopt performance measures based on comprehensive assessment of regional and project-specific monitoring data, hypothesis testing, and statistical analyses.

CALFED's problem in assessing the performance of numerous programs and activities is not unique. A recent national report, partly funded by CALFED, confirms the need for evaluating the effectiveness of restoration actions.<sup>6</sup> This is especially true in California, where there have been large expenditures on river restoration projects through CALFED, the Anadromous Fish Restoration Program (AFRP), the California Departments of Fish and Game and Water Resources, the State Water Resources Control Board, and many other entities. The investment in restoration activities supported by these agencies has helped to increase the data available to assess changes in the Bay-Delta ecosystem. In the California "node" of the recent National River Restoration Science Synthesis (NRRSS) study, approximately 22% of the projects in California reported some kind of monitoring, which is higher than the national average. While this result indicates that data are being generated by projects, it appears that these data are not being effectively used to optimize the learning potential of previously funded restoration activities. Much of the information from monitoring of individual projects will yield more useful results if assessed with, and in the context of, other similar projects. Despite this and CALFED's acknowledged need for performance assessment (and particularly in light of recent critiques by frustrated lawmakers anxious to understand CALFED's progress), it appears that none of the proposals preliminarily recommended for funding by the Science Program fill this need.

The technical reviewers of our "Multi-watershed" proposal strongly supported the need for CALFED to engage in the type of compilation, data mining, analysis, and effectiveness evaluation of ecosystem restoration actions that we proposed. The reviewers and the Synthesis Panel identified a few concerns about the proposal, which we address in Table 1.

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<sup>2</sup> CALFED Indicators Workgroup (CALFED). 1998. Framework process for CALFED ecosystem restoration program ecological indicators development. CALFED Bay-Delta Program, Sacramento, California.

<sup>3</sup> Young, T. R. Fujita, S. Birk, D. Morrison, A. L. Pawley, and P. Rhoads 1998. Conceptual framework for indicator development: development of key ecological attributes for the San Francisco Bay-Delta watershed CALFED Bay-Delta Program. Interagency Ecological Program for the Sacramento-San Joaquin Estuary 11(2):6-10.

<sup>4</sup> Pawley, A. 2000. Program Performance Indicators for the CALFED Bay-Delta Ecosystem Restoration Program. Report prepared for the CALFED Science Program. The Bay Institute, Novato, California. pp.120. Available at <http://www.bay.org/science/Indrpt02.pdf>.

<sup>5</sup> Information available at: <http://science.calwater.ca.gov/library.shtml>

<sup>6</sup> A summary article about the analysis appears in *Science*: Bernhardt, E.S., M.A. Palmer, J.D. Allan, G. Alexander, K. Barnas, S. Brooks, J. Carr, S. Clayton, C. Dahm, J. Follstad-Shah, D. Galat, S. Gloss, P. Goodwin, D. Hart, B. Hassett, R. Jenkinson, S. Katz, G.M. Kondolf, P.S. Lake, R. Lave, J.L. Meyer, T.K. O'Donnell, L. Pagano, B. Powell, and E. Sudduth. 2005. Synthesizing U.S. river restoration efforts. *Science* 308: 636-637.

Table 1. Summary of the reviewer's comments and the proposal team's clarifications.

| Reviewer            | Reviewer's Comment   | Clarification   |
|---------------------|--|---|
| Technical Review #1 | <b>Summary:</b> Of the 7 relevant rating criteria, this reviewer marked 6 excellent ratings. The budget was thought to be expensive and was rated good. Overall, the proposal was viewed as excellent; it was well-justified, well thought out, very likely to succeed, contained useful products, and lead by a qualified team. As well, the reviewer noted, "If a project of this type has not been carried out before then it is important that it is done soon..." |   |
|                     | "The project is expensive. I have not looked carefully at the costs involved, but these should be scrutinized carefully by someone who is used to evaluating such things."   | The "Multi-watershed" project proposes to use a collaborative approach in which the project team engages local experts who are familiar with the project-level data that CALFED, AFRP, and CDFG funds have been supporting. Considering the hundreds of restoration projects that have been funded over the past ten years, it will be no small task to contact numerous people to identify, acquire, assess, and analyze data. Based on our experience in the Columbia Basin, data compilation and analyses are not trivial tasks. Integrating data sets from disparate sources takes time and effort.   |
| Technical Review #2 | <b>Summary:</b> Overall, the proposal was rated as very good, receiving 1 excellent, 5 very good, and 1 good rating for relevant criteria. This reviewer was impressed with the proposal noting, "It is quite ambitious and attempts a very difficult problem that has for too long been shied-away from. I have little doubt that it will deliver useful and practical results." The main concerns were related to the proposed approach, as highlighted below.       |   |
|                     | "there were no specific hypotheses"  | It is difficult to define specific testable hypotheses until Task 1 (scoping and formulation of overarching hypotheses) and Task 2 (data acquisition, organization, and review) are completed. We provided generic forms and simple examples to illustrate the types of hypotheses we planned to test (page 7). The Columbia Basin report that we referenced in our proposal (sections A.5. and B.1.) and Appendix A of this letter illustrate how generic hypotheses are transformed into specific testable hypotheses following the data inventory and development of a Data Analysis Plan. This referenced study is available at <a href="http://www.essa.com/watersh-rpt.pdf">http://www.essa.com/watersh-rpt.pdf</a> . |
|                     | "approach was presented more as an outline, and was thin on technical detail, and I would have liked to have seen more detail on statistical methods and conceptual models"  | More detailed plans are impossible to specify precisely until the first 2 phases have been completed.   |
|                     | "like to have seen a brief example drawn from the Columbia River project to illustrate the types of results and interpretations"   | Page limitations precluded extensive descriptions of the Columbia Basin project, but the proposal references and briefly describes the overall approach, lessons learned, and some selected examples of analyses used in the Columbia Basin project in sections A.5. and B.1.   |
|                     | "concerns whether their statistical techniques comparing multiple restoration sites will allow for accounting of the relationships that exist between sites in a stream network context"   | Spatial autocorrelation can be a concern if restoration sites are closely clustered. The Data Analysis Plan would consider such issues.   |
|                     | "hope to see some effort expended towards other approaches besides just classical statistics"  | In the proposal we stated that there would probably be a need to develop new statistical approaches. We cannot, however, anticipate these needs prior to conducting data reconnaissance. Our team is familiar with meta-analysis, Bayesian, and other less traditional statistical approaches.  |

| Reviewer            | Reviewer's Comment   | Clarification  |
|---------------------|--|--|
| Technical Review #3 | Summary: This reviewer rated the proposal as excellent overall, with 1 very good and 6 excellent individual scores. The reviewer appreciated the "big picture" approach noting, "A comparative, synthetic approach to the evaluation of specific restoration practices is sorely needed, as is greater clarity of the appropriate design of monitoring projects." Several questions were raised with respect to the compilation and analyses stages (see below). |  |
|                     | "reservation is whether enough projects are now in the CALFED database, and enough time has elapsed, for evaluation to make sense"   | CALFED has been funding hundreds of restoration projects for nearly 10 years, and there are many earlier projects funded by a variety of entities prior to this date (see <a href="http://www.ice.ucdavis.edu/nrpi/">http://www.ice.ucdavis.edu/nrpi/</a> ). It seems reasonable to expect that there would be sufficient data to support a larger landscape-level analysis, especially in light of the requirement that projects funded by the CALFED ERP and Science Program include monitoring plans. The number and quality of projects presented at the three biennial CALFED Science Conferences also suggest the availability of data from projects implemented in the Bay-Delta watershed. And as discussed before, the NRRSS study (Bernhardt et al. 2005) indicated that more California projects generally include some form of monitoring as compared to the national average, suggesting a greater likelihood that sufficient project level data are available to support a larger landscape-scale analysis. An assessment of the effects of restoration projects funded to date will provide the type of information that CALFED needs to communicate its progress with lawmakers, the public, and other stakeholders. |
|                     | "confused regarding the evaluation of habitat vs. biological data (they seem to be emphasizing the former), and how well they can relate the two"  | Both habitat and fish performance measures (PMs) must be considered for effectiveness evaluations. Habitat PMs may need to serve as "proxy PMs" where fish PMs are inadequate or unavailable.  |
|                     | "difficult question of whether enough time has elapsed for change (improvements) to be observed"   | System response to management actions can take time to register, but multi-watershed analysis can help to optimize the utility and learning value of available data. By combining data from multiple individual projects and assessing them in relation to regional status and trends monitoring, we can make inferences that would not be available if we limited our analysis to the project scale or reach-scale.<br><br>As discussed in the proposal and in comments above, CALFED and other entities have been investing in restoration actions for many years: for some types of restoration actions there may be as many as ten or more years of post-project data available. As the primary biological focus of our proposed analyses, salmon generally exhibit a three-year life cycle. We anticipate at least some opportunities to assess their response over multiple generations. In addition, in a number of streams monitoring data for juvenile salmon are available, offering the opportunity to assess more immediate effects of restoration actions, especially if they address density independent mortality.  |
|                     | "preferred to know more about the database that this project will work with"   | In the proposal, we referenced existing project databases (e.g., NRPI, ICE, TERA) that could be used to help guide the identification of potential project data. Since the proposal submission, the NRRSS study has been initiated (Bernhardt et al. 2005), which may also provide signposts to existing data. The page limitations imposed by the PSP made it difficult to define all of the components of the proposed approach in sufficient detail, so we referenced existing databases in the hope that reviewers would be familiar with them.  |

| Reviewer                  | Reviewer's Comment   | Clarification  |
|---------------------------|--|--|
|                           | "extent and type of data available are uncertain"  | Again, Tasks 1 and 2 of the proposed approach are designed to assess the availability of data to test restoration hypotheses. Data availability is not a binomial switch; it is more of a continuum. That is, the availability and quality of data will determine the types and resolution of hypotheses that can be tested, not whether hypotheses can be tested at all.<br>We also share this reviewer's general assessment that there is likely sufficient project data to support a multi-watershed analysis.  |
|                           | "\$742K might be high"   | As recognized by each of the Technical Reviewers, data acquisition and organization is, in itself, a large undertaking, and the resulting database would be a valuable tool for evaluating the effectiveness of completed restoration projects in meeting CALFED goals. Unfortunately, it is not feasible to complete data acquisition and develop specific hypotheses that can be tested using those data as part of the proposal effort prior to the actual project. A phased funding approach could support this initial work (including hypothesis development and refinement of statistical methods) and ensure that the database is compiled, while making future funding contingent on the outcome of this phase.   |
| Technical Synthesis Panel | Summary: The final panel rating was adequate. The panel noted it was good that we were proposing to use a model developed and tested on the Columbia River. As well, the panel recognized that there is a great need to evaluate restoration projects on a multi-watershed scale. However, they felt that this proposal had little substance and "requires a different level of commitment and development." |  |
|                           | "should have done some preliminary data mining to test the feasibility of this project"  | Tasks 1 and 2 of the proposed project are designed to guide the identification, acquisition, assessment, and organization of available data so that the process is ordered, rational, and hypothesis-driven. As discussed earlier, using a collaborative approach to engage numerous local and project experts to mine data is no small task, and one that cannot feasibly be conducted as part of a proposal effort. "Preliminary data mining" runs the risk of being scattered, and it poses the risk of alienating local and project experts that are asked to supply data solely to support the development of a proposal. A multi-watershed analysis like the one proposed will benefit when it has a wide pool of data from which to draw. Engaging a wide range of project implementers who share their data requires a careful and collaborative approach that cannot be implemented within the short timeframe allowed for CALFED proposal development. |
|                           | "while it's mentioned that hypotheses will be tested – they are not specifically listed"   | Task 1 of the proposed approach is designed to develop general hypotheses that guide the identification, acquisition, and assessment of project data in Task 2. With the acquisition of data, it is then possible to define more specific hypotheses. We provided examples of nested hypotheses in the proposal and in Appendix A of this letter to demonstrate the type of hypotheses that we expect to be tested using our approach.   |
|                           | "should have proposed some potential new statistical approaches rather than old classic approaches such as BACI"   | Table 1 on page 29 of the proposal cited several potential statistical methods, of which BACI represented only one approach. The project team includes statistical experts (Dr. Carl Schwarz and Dr. Peter Baker) who have extensive experience in developing innovative techniques for analyzing data.  |
|                           | "data that will be used are not identified"  | The actual extent and quality of data sets that are available could not be anticipated prior to completing the data reconnaissance phases. However, in the proposal we did list existing databases that we believe would be important information sources, and did receive letters of support from those individuals who would be important data providers and collaborators.  |

| Reviewer | Reviewer's Comment  | Clarification  |
|----------|---|--|
|          | "this project is complex and will require more than routine analysis and, therefore, require more time from lead scientists to guide the mid-level staff" | The entire team is highly qualified (with the exception of RAs), with ample time of senior staff budgeted to direct the analysis. We know from Columbia River work the required proportion of time for different levels of staff, so that the approach can be both well-directed and cost-efficient. |

The most common comment seemed to focus on the availability of data to support the proposed analysis, and the lack of detailed hypotheses in the proposal. We have explained in this letter that Task 1 and Task 2 of the proposed approach is designed to address these issues by using an approach that helps ensure the identification, acquisition, assessment, and organization of available data is hypothesis-driven, ordered, rational, and collaborative. If the Science Program has flexibility, we would suggest that it consider providing funding for the first two tasks as a scoping effort for the overall project (~\$209,000):

- Task 1: Scope and formulate hypotheses related to ecosystem restoration, and
- Task 2: Assemble and review available information to identify types of restoration actions and watersheds with sufficient data to test restoration hypotheses.

Completion of the first two tasks would provide valuable information for CALFED, including the development of landscape-scale restoration hypotheses to be tested, the availability of data to test those hypotheses, and an indication of project implementer willingness to participate in the project by providing data. These products alone would be valuable. CALFED, or other funding sources, could then use the results of this scoping phase to determine if completion of the proposed approach was warranted.

We understand the reviewers' and Synthesis Panel's desire for more detail. As scientists, we also value detail, and we have tried to describe how such detail is best achieved by the organized, hypothesis-driven, collaborative approach that we have proposed. We also appreciate the favorable reviews of the proposed analytic approach, and we hope that you agree the time is ripe for CALFED to support a landscape-level analysis of the effects of the hundreds of restoration actions, representing an investment of hundreds of millions of dollars, that have been implemented in the last decade.

Regards,



Christina Swanson, Ph.D. on behalf of:  
 Anitra Pawley, Ph.D.  
 Peter Vorster  
 David R. Marmorek  
 Ian Parnell  
 Marc Nelitz  
 Carl James Schwarz, Ph.D.  
 Michael Fainter  
 Peter Baker, Ph.D.  
 Frank Ligon  
 Jennifer C. Vick  
 Scott McBain  
 William Joseph Trush, Ph.D.  
 John Hamilton Bair  
 G. Mathias Kondolf, Ph.D.

## Appendix A

Our proposal cited Marmorek et al. (2004)<sup>7</sup> several times. With respect to the process we intend to use, the following extracts some of the critical points relating to the issue of developing testable hypotheses. Moving from general hypotheses to specific testable restoration hypotheses is not trivial. The process of selecting a set of testable hypotheses for this project involved three multi-agency workshops. In the first (data scoping) workshop we met with a Core Group of habitat experts and managers to establish a set of potentially testable habitat restoration hypotheses, identify candidate watersheds in the Columbia Basin with the best biological data and recommend participants for a subsequent data evaluation workshop. At this second (data evaluation) workshop agency experts provided detailed information on habitat restoration projects that had/were being undertaken in each of these candidate watersheds, as well as the type and extent of biological monitoring datasets that were available for analyses. Following this workshop historical datasets and supporting documentation describing restoration projects and biological inventory/monitoring within each of the candidate subbasins were obtained from various fisheries agencies operating in the Columbia. These data were then reviewed by a select group of fisheries scientists and biostatisticians with expertise in Columbia basin fish monitoring studies as well as in large-scale experimental design at a third (data analysis) workshop. Experts convened to further assess the quality of the available subbasin data and refine possible approaches for statistical analysis. The data analysis workshop identified the locations of restoration activities that could provide thorough tests of action effectiveness. These activities subsequently became the focus for the detailed statistical analyses undertaken in the project.

As an **example** (from section 2.0 of Marmorek et al. 2004), at our first workshop it was determined that the Yakima subbasin had a good time series of historical run-reconstructions derived from dam counts at Prosser and Roza dams and extensive redd surveys dating back to 1982. The subbasin also had accurate smolt counts dating back to the same period from their juvenile counting facility at Chandler Canal. Within this period of collected biological data there had also been an extensive program of fish screen improvements (Phase I screens) undertaken across all major irrigation/power canals in the Yakima subbasin. The Yakima was therefore selected as a candidate for possible testing of a restoration hypothesis relating to the screening program. Through discussions with Yakima fisheries biologists at our second workshop we determined that three distinct stocks of spring chinook spawn upriver of the major screened canals in the Yakima subbasin; smolts of these stocks must descend past these screens during their outmigration. We ascertained that USGS gauging stations are present at each of these canals providing historical information on mainstem flows at these points in the river and the proportional amount of river flow diverted daily into each of the canals. We also learned that canal certification studies at Chandler Canal had quantified the relationship between the proportion of Yakima mainstem flow diverted and the proportion of smolts subsequently entrained into a canal (entrainment rate). They had also quantified the relationship between smolt entrainment rates and subsequent survival rates within the canal, both before and after construction of new fish screens. Our third workshop focused on expanding the relationships from the Chandler Certification reports into a general system-wide survival index that could be used to quantify the changing survival rates of smolts due to screening. We also needed to identify appropriate 'control' watersheds (the Wenatchee and Warm Springs basins were selected). This involved considerable discussion with Yakima biologists prior to, during, and after our third workshop to clarify our testable hypothesis (e.g., improved smolt survival at Yakima screened canals increases subbasin fish productivity, as measured by smolts/spawner or returns/spawner, relative to control areas and the pre-screening period) and analytical approach (e.g., a series of log-linear regression models relating the time series of subbasin screening to fish productivity). We also needed to resolve issues relating to chinook migration patterns in the Yakima, details of canal operations and past modeling of survival rates, weaknesses and gaps in the available fish population datasets, and identification of appropriate covariates and controls.

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<sup>7</sup> Marmorek, D.R., I.J. Parnell, M. Porter, C. Pinkham, C.A.D. Alexander, C.N. Peters, J. Hubble, C.M. Paulsen and T.R. Fisher. 2004. *A Multiple Watershed Approach to Assessing the Effects of Habitat Restoration Actions on Anadromous and Resident Fish Populations*. Prepared by ESSA Technologies Ltd., Vancouver, B.C. for Bonneville Power Administration, Portland, OR. 420 pp. [www.efw.bpa.gov/Publications/H00012481-1.pdf](http://www.efw.bpa.gov/Publications/H00012481-1.pdf)

# Technical Synthesis Panel Review

## Proposal Title

#0126: Using Multi–Watershed Analyses to Analyze the Effects and Improve the Experimental Design of Ecosystem Restoration Actions

| Final Panel Rating |
|--------------------|
| adequate           |

## Technical Synthesis Panel (Primary) Review

### TSP Primary Reviewer's Evaluation Summary And Rating:

The proposal address CALFED needs in that it will review restoration projects for comparative analyses... it will data mine. It will develop its own set of hypotheses to test (no presented however) but not see how ongoing or completed projects tested their hypotheses. It will use a model developed and tested on the Columbia River (good). The PIs should have done some preliminary data mining to test the feasibility of this project. The PIs should have proposed some potential new statistical approaches rather than old classic approaches such as BACI. The proposal needs more thorough development. The Columbia model should enhance the potential for success of this project. The PIs are highly qualified but should know better than not to produce a more comprehensive proposal.

### Additional Comments:

The proposal address CALFED needs in that it will review restoration projects for comparative analyses... it will data mine. It will develop its own set of hypotheses to test (no presented however) but not see how ongoing or completed projects tested their hypotheses. It will use a model

#0126: Using Multi–Watershed Analyses to Analyze the Effects and Improve the ...

## Technical Synthesis Panel Review

developed and tested on the Columbia River (good). The PIs should have done some preliminary data mining to test the feasibility of this project. The PIs should have proposed some potential new statistical approaches rather than old classic approaches such as BACI. The proposal needs more thorough development. The Columbia model should enhance the potential for success of this project. The PIs are highly qualified but should know better than not to produce a more comprehensive proposal.

## Technical Synthesis Panel (Discussion) Review

### TSP Observations, Findings And Recommendations:

The proposal team is made up of an excellent group of scientists. There is a great need within CalFed for the evaluation of restoration projects on a multi-watershed scale. This proposal, however, has little substance. While it's mentioned that hypotheses will be tested - they are not specifically listed. Data that will be used are not identified. While several statistical approaches are noted, others (as noted by ad hoc reviewers) should be considered and should be developed to test more theoretical concepts that would come from hypotheses, had they been stated. This project is complex and will require more than routine analysis and, therefore, require more time from lead scientists to guide the mid-level staff. The proposal was not fully thought through from objectives to hypotheses, analysis and interpretation. This proposal requires a different level of commitment and development.

[In the web form the rating entered for this proposal was:  
Adequate]

# Technical Review #1

proposal title: Using Multi–Watershed Analyses to Analyze the Effects and Improve the Experimental Design of Ecosystem Restoration Actions

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

|                 |   |
|-----------------|---|
| <b>Comments</b> | The goals, objectives and hypotheses are very clearly stated and are internally consistent. This is an important project. |
| <b>Rating</b>   | excellent   |

### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full–scale implementation project justified?

|                 |  |
|-----------------|--|
| <b>Comments</b> | The study is certainly justified in terms of existing knowledge because it will take existing knowledge (data from projects completed in the past) to better understand what they indicate about the effectiveness or not of different management actions. |
| <b>Rating</b>   | excellent  |

### Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

## Technical Review #1

|                 |  |
|-----------------|--|
| <b>Comments</b> | The approach seems well thought out, and is certainly feasible. It seems inevitable that the project will generate information that is useful to decision makers, even if this takes the form that the effectiveness of certain management actions in the past is not well demonstrated. |
| <b>Rating</b>   | excellent  |

## Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success?  
Is the scale of the project consistent with the objectives and within the grasp of authors?

|                 |   |
|-----------------|---|
| <b>Comments</b> | The approach is very well documented, and I believe that it has a high likelihood of success. The scale seems appropriate and the authors are well qualified to carry it out. |
| <b>Rating</b>   | excellent   |

## Monitoring

If applicable, is monitoring appropriately designed (pre–post comparisons; treatment–control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

|                 |  |
|-----------------|--|
| <b>Comments</b> | This is not really an appropriate issue. |
| <b>Rating</b>   | excellent                                |

## Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

|                 |  |
|-----------------|--|
| <b>Comments</b> | Yes, the products will inevitably be of value and will be relevant to larger data management systems. The results should be interpretable assuming that appropriate analyses are |
|-----------------|--|

## Technical Review #1

|        |            |
|--------|------------|
|        | conducted. |
| Rating | excellent  |

### Additional Comments

|          |  |
|----------|--|
| Comments | If a project of this type has not been carried out before then it is important that it is done soon so that the results of past projects are fully utilized. |
|----------|--|

### Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

|          |   |
|----------|---|
| Comments | The track records of the authors are all extremely good and the project team seems very well qualified for the project. The infrastructure and other support seems very adequate. |
| Rating   | excellent   |

### Budget

Is the budget reasonable and adequate for the work proposed?

|          |  |
|----------|--|
| Comments | The project is expensive. I have not looked carefully at the costs involved, but these should be scrutinised carefully by someone who is used to evaluating such things. |
| Rating   | good   |

### Overall

Provide a brief explanation of your summary rating.

Technical Review #1

|                 |   |
|-----------------|---|
| <b>Comments</b> | It is very important to review the outcomes of all projects completed in the past as a whole at regular periods of time to ensure that the maximum information is gained from the outcomes. I imagine that if this project goes as expected then the exercise should be repeated again every 10-15 years. |
| <b>Rating</b>   | excellent   |

# Technical Review #2

proposal title: Using Multi–Watershed Analyses to Analyze the Effects and Improve the Experimental Design of Ecosystem Restoration Actions

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

|          |   |
|----------|---|
| Comments | Overall this was a very well written and constructed proposal that was easy to comprehend; the goals, objectives were clearly presented--there were no specific hypotheses. It also appears to meet a critical need for the CALFED program at this juncture in its development, namely an overall analysis of restoration activities. |
| Rating   | very good   |

### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full–scale implementation project justified?

|          |  |
|----------|--|
| Comments | The study is justified in relation to existing information and data. With hundreds of completed and ongoing restoration projects, a need exists to provide a coherent meta-analysis and synthesis of results to guide future activities and allocate resources most effectively. |
| Rating   | very good  |

## Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

|                        |   |
|------------------------|---|
| <p><b>Comments</b></p> | <p>Overall the approach appears to be well designed and patterned after a project in the Columbia basin with similar objectives. However, the approach was presented more as an outline, and was thin on technical detail, and I would have liked to have seen more detail on statistical methods and conceptual models that will be expected to be used. I would liked to have seen perhaps a brief example drawn from the Columbia River project to illustrate the types of results and interpretations that were realized there and how the achieved broader scope facilitated novel solutions. That said, I am left with the impression that this project will certainly add to the base of knowledge needed to guide restoration activities at a broad landscape scale, and that it can be achieved within a timeline relevant to restoration activities.</p> <p>That being said, I do see some room for improvement. Given that the overall objective is to increase understanding and assessment of restoration activities at a whole-basin level, I have some concerns whether their statistical techniques comparing multiple restoration sites will allow for accounting of the relationships that exist between sites in a stream network context. Their "Toolbox" presents a gradation of standard statistical techniques ranging from best case scenario of BACI , the crown jewel of ecological effects studies, to qualitative assessments of case studies, the more pedestrian article. I would</p> |
|------------------------|---|

## Technical Review #2

|               |  |
|---------------|--|
|               | <p>hope to see some effort expended towards other approaches besides just classical statistics, and I firmly believe that understanding would be improved by inclusion of complementary approaches, that while not purely parametric are nonetheless rigorous. Structured equation modelling could provide a means to address the influence of the mechanistic and network properties of stream systems. And qualitative approaches, which appear to be only based in literature review, could be enhanced by more formal methods, such as qualitative modelling (eg. Puccia and Levins 1985, Qualitative modelling of complex systems, Harvard University Press). Adding these approaches to the "toolbox" would add another dimension to the study and add rigor and strength to the task of developing and analysing the conceptual models. It would also improve engagement of both the biologists and public during consultation.</p> |
| <b>Rating</b> | very good  |

## Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success?  
 Is the scale of the project consistent with the objectives and within the grasp of authors?

|                 |  |
|-----------------|--|
| <b>Comments</b> | <p>The approach is fully documented with peer-reviewed examples and has previously proven effective in prior applications. The whole-basin/landscape approach is consistent with the broad objectives proposed. The previous success of the applicant's Columbia basin project suggests there should be little reason to doubt the likelihood of achieving their goals in the current proposal. The biggest challenge will likely be in the coordination and acquisition of data from disparate sources, but this appears to be well recognized and planned for.</p> |
| <b>Rating</b>   |  |

## Technical Review #2

|  |           |
|--|-----------|
|  | very good |
|--|-----------|

### Monitoring

If applicable, is monitoring appropriately designed (pre–post comparisons; treatment–control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

|          |   |
|----------|---|
| Comments | Perhaps not applicable here, as this is not tied to specific project, however, monitoring the monitoring is really the core of the proposed work. |
| Rating   | not applicable  |

### Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

|          |   |
|----------|---|
| Comments | The products to be delivered from this project are high in value and relevant to the core objectives of the CALFED program. The planned outcomes are likely to be very appropriate to the management of stream restoration activities, the delivery of a standardized analysis of a very messy problem, should allow resource managers to engage each other with a common understanding of restoration results and needs. |
| Rating   | very good   |

### Additional Comments

|          |
|----------|
| Comments |
|----------|

## Technical Review #2

### Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

|          |  |
|----------|--|
| Comments | The authors and project team appear to be of the highest qualifications and have been successful before in delivering a similar project. They appear to know of, and have accounted for, major challenges and hurdles. They appear to have an extensive collaborative network of experiences professionals to draw upon. |
| Rating   | excellent  |

### Budget

Is the budget reasonable and adequate for the work proposed?

|          |   |
|----------|---|
| Comments | The budget seems reasonable and adequate. But I must admit that I have not gone through it with a fine-tooth comb, nor do I believe that I am entirely qualified to judge it well, as I have not managed a project of this scope in the private sector. |
| Rating   | good  |

### Overall

Provide a brief explanation of your summary rating.

|          |   |
|----------|---|
| Comments | As you would surmise from my comments I am well impressed with this proposal. It is quite ambitious and attempts a very difficult problem that has for too long been shied-away from. I have little doubt that it will deliver useful and practical results. My concerns about the toolbox being somewhat limited in approach could be applied to most ecological studies, and is |
|----------|---|

Technical Review #2

|        |  |
|--------|--|
|        | not a special concern. The authors of the proposal are likely able to address my concerns through their extensive experience and intuition, however, the techniques I suggest would help to formalize these thought processes and make them more amenable to analysis and public engagement—always a good thing. |
| Rating | very good  |

# Technical Review #3

proposal title: Using Multi–Watershed Analyses to Analyze the Effects and Improve the Experimental Design of Ecosystem Restoration Actions

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

|          |   |
|----------|---|
| Comments | Golas and hypotheses are clearly stated. This is a very timely exercise in systematically learning about restoration success through data mining and comparative analysis of calfed projects. The PIs make an excellent point that, while Calfed has required monitoring, thier has been little effort to systematically compile and compare data from multiple projects. My only reservation is whether enough projects are now in the Calfed database, and enough time has elapsed, for evaluation to make sense, or whether this project might be a bit premature. Even if it is early in the game, I would support this project, with the expectation that it should be re-visited at, say, 5-year intervals. |
| Rating   | excellent   |

### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full–scale implementation project justified?

|          |  |
|----------|--|
| Comments | highly relevant evaluation of restoration success and of the design and analysis criteria appropriate to restoration evaluation. |
|----------|--|

### Technical Review #3

|               |   |
|---------------|---|
|               | <p>strongly justified also by prior work on Columbia, which looks to be an excellent model.</p> <p>will "tighten the adaptive management loop" (nice phrase!)</p> |
| <b>Rating</b> | <b>excellent</b>  |

## Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

|                 |   |
|-----------------|---|
| <b>Comments</b> | <p>I like their explanations of landscape and multi-scale watershed comparisons in an 'informal' experimental design. The PIs show a good grasp of how to approach the problem. I also like their focus on specific restoration activities aimed at salmonids. The PIs present an intriguing argument for testing various monitoring designs, in recognition of the difficulties of observing (and interpreting) recovery or lack of recovery. Again, they provide a sophisticated discussion of the challenges of experimental design in the context of evaluating restoration success. This is the best such discussion I have read. (But it appears that the general approach has been proposed or used before in the Pac NW after which this is patterned.) I am a bit confused regarding the evaluation of habitat vs biological data (they seem to be emphasizing the former), and how well they can relate the two. I am unclear just how many studies they expect to identify and include. And then there is the difficult question of whether enough time has elapsed for change (improvements) to be be</p> |
|-----------------|---|

### Technical Review #3

|               |   |
|---------------|---|
|               | <p>observed. Tyhe lengthy description of the Columbia River project on which this study is patterned was of some help, but felt overly-detailed. I would have preferred to know more about the database that this project will work with. The description of workshops makes it clear that they will determine what data are available as part of the project itself, so we have no way of assessing how rich the data are. On the plus side, the development of the database is a critical function in its own right, and the proposal does a good job of describing the process. I also am persuaded that they will be able to perform power and other analyses that will provide valuable information on design adequacy, tradeoffs, covariates, etc. Indeed, by later in the proposal, I began to feel that the PIs' strongest justification lies in the development of statistical design and analysis fo restoration projects. How well they will also answer specific questions for specific restoration activities aimed at salmonids feels less certian, and less critical.</p> <p>It is my understanding that this project will look at very specific project outcome data, including habitat and biological measures. This level of specificity is a plus.</p> |
| <b>Rating</b> | excellent   |

## Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success?  
Is the scale of the project consistent with the objectives and within the grasp of authors?

|                 |  |
|-----------------|--|
| <b>Comments</b> |  |
|-----------------|--|

### Technical Review #3

|        |  |
|--------|--|
|        | The approach is technically feasible. The extent and type of data available are uncertain. Nonetheless, I expect there will be sufficient data for the analysis to proceed. The very act of beginning the development of such a database is valuable. I expect the PIs will be able to provide valuable insights into the design and analysis of restoration projects. |
| Rating | excellent  |

## Monitoring

If applicable, is monitoring appropriately designed (pre–post comparisons; treatment–control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

|          |   |
|----------|---|
| Comments | N/A. This is more of a meta-analysis of existing monitoring data from prior projects. |
| Rating   | excellent   |

## Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

|          |                     |
|----------|---------------------|
| Comments | Yes, well described |
| Rating   | excellent           |

## Additional Comments

|          |                          |
|----------|--------------------------|
| Comments | novel and important work |
|----------|--------------------------|

## Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

### Technical Review #3

|                 |  |
|-----------------|--|
| <b>Comments</b> | I don't know most of these people. Some well-known names. Prior involvement in Columbia River analysis is a strong indicator of their abilities. Credentials are impressive. |
| <b>Rating</b>   | excellent  |

## Budget

Is the budget reasonable and adequate for the work proposed?

|                 |  |
|-----------------|--|
| <b>Comments</b> | \$742k might be high but there are a lot of people involved, and one assumes there are a lot of data to be gathered. |
| <b>Rating</b>   | very good  |

## Overall

Provide a brief explanation of your summary rating.

|                 |  |
|-----------------|--|
| <b>Comments</b> | I like the 'big picture' approach of this proposal. The presentation is sophisticated and thoughtful. The diagrams also help to demonstrate a well-thought out structure. A comparative, synthetic approach to the evaluation of specific restoration practices is sorely needed, as is greater clarity of the appropriate design of monitoring projects. This should contribute substantially to those goals. |
| <b>Rating</b>   | excellent  |